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LUMINARY MEMO #135

TO: Distribution
FROM: Robert Covelli
DATE: January 23, 1970
SUBJECT: Downrupt Losses During Periods of High Computer Activity Programs

During the testing of LUMINARY programs at KSC, a P66 simflite run lost several downrupts. This brought up questions of whether this is a real problem in the software.

It has long been known that during periods of high computer interrupt activity downrupts can be lost. This happens when higher priority interrupts prevent a downrupt from being processed before the telemetry data is sent to the ground. For more information see LUMINARY Memo #89, "A Metaphysic of Downrupts" by P. Adler and D. Densmore.

For example, the period of maximum interrupt activity in LUMINARY is during the powered descent programs: P63 - P66. In every two second guidance cycle, the following interrupts occur:

1	T3RUPT for READACCS
1	T3RUPT for R12
6	RADARUPTs for R12
16	T3RUPTs for R10
20	T5RUPTs for the DAP
16-17	T4RUPTs for IMU and DSKY
1	T3RUPT for P66
Up to 3	T3RUPTs for IMU Compensation
100	Downrupts

In addition, there may be several T6RUPT's to turn off RCS jets; and other interrupts from DSKY keystrokes, RHC activity, and ROD inputs.

In order to minimize the possibility of lost downrupts during this period of peak activity, the phasing of the periodic interrupts is controlled to prevent synchronization of the longer rupts. The DAP T5RUPTs, the R10 T3 RUPTs, and READACCS are phased so that they do not overlap. In most of the LUMINARY testing on the all digital simulator, no more than three or four downrupts have been lost during the entire sequence of descent programs.

Because of the above precautions, I do not believe that the observed loss of downrupts is caused by the P66 software. The cause of this problem is probably the nature of the simflite testing.

In a simflite test, the LGC not only executes the program being tested, but it also simulates the enviornment by torqueing the IMU and giving the PIPAs at the proper times. The erasable programs that perform these functions are controlled by T3RUPTs. It is possible that the added interrupt activity caused by these programs is the cause of the lost downrupts.

In order to analyze the interrupt activity during P66 simflite, a special version of the all digital simulator could be made which would simulate the simflite enviornment. The simflite testing could then be simulated on the all digital simulator and the interrupt activity can be printed on-line. This would require extensive modification to the all digital simulator.

Whether the above testing is done or not, I believe that the low frequency of lost downrupts during the digital simulations indicates that there is no problem with the software.